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ABSTRACT

A framework for marine and aquatic education in Hawaii was developed for the purpose of restructuring attitudes on the use, protection, and appreciation of aquatic resources. This report identifies key elements of the framework and contains suggestions for its implementation and management. Contents include: (1) a rationale for marine education (providing a list of competency statements); (2) goals and objectives (discussing four major objectives of marine and aquatic education and their relationship to Hawaii's general educational goals); (3) a concept attainment model (specifying the concepts considered to be important for the attainment of marine literacy); (4) scope and sequence (explaining core themes, key issues, and areas of emphasis for K through 12 grade levels); (5) administrative objectives (offering suggestions for program development and maintenance); (6) communication concerns (describing the functions and communication possibilities at state, district, and school levels); and (7) staff development (stating the components needed in coordinating a staff development program). A listing of 12 references is also included. (ML)

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MARINE AND OTHER AQUATIC EDUCATION FRAMEWORK

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I. BACKGROUND

A. Introduction

The earth is a water planet with the oceans covering close to seventy per cent of the earth's surface and containing more than ninety-seven per cent of its waters. Although there is a tendency by humans to divide the seas into separate sections, there is but one ocean with interconnecting basins. The aquatic environments have had a tremendous impact throughout the history of the earth on the quality and the very existence of life. Despite the close relationship of these aquatic environments with the life on the planet, the human population has been mainly land-based for its resources and activities. As this population increases, as the available land decreases for agricultural uses and resource acquisition, and as the technology of modern society becomes more sophisticated, the human population has been turning to the sea for its resources (food, oil, minerals, and other types of raw materials). Under the present conditions that exist on the earth, any small change in population, land use, or technological advancement will have major impacts on the aquatic environments, both fresh and salt water.

In considering the ecological systems of the ocean, and people's interaction and impact on these systems, it is important that the issues involved be dealt with from a global, a national, and a local perspective to ensure coordination of effort and understanding about the wise use of these ecosystems.

As human's use of the ocean grows in scale and complexity, so does the need for resolving jurisdictional problems and the development of regional and international managmenet schemes. To resolve conflicts and deal with issues that are inherent in these conflicts, nations are attempting to construct a "law of the sea" that meets today's needs.

In the seventeenth century Hugo Grotius, a Dutch jurist, put forth the idea that the ocean and its resources belonged to everyone equally. This Grotial concept was acceptable as long as the primary uses of the

ocean were for communication, transportation of goods, and limited scientific investigations. However, the interpretation of this concept began to undergo major changes as the exploitation of the sea floor by various nations increased.

The first major thrust of a seaward extension by a coastal nation came in 1945 from the United States. President Truman declared that the United States had the right to resources on and beneath the sea bed along its entire continental shelf, and with that declaration many other nations using the Truman Doctrine as a guide quickly followed suit. This was the beginning of the international concept of "property held in trust" with an apparent shift in legal status about the terms of management control. The movement is away from the Grotial concept of "common property" of the ocean and the rights to the resources contained therein to that of property held in public trust within the economic zones of control of the individual coastal nations.

Globally the world's nations have attempted to resolve several issues with respect to the use of the sea. Some of the major issues have been: (a) the rights of all nations to use of the sea; (b) the rights of innocent passage through territorial and contiguous waters; (c) the rights of control over the continental shelves; (d) the rights of coastal nations to control the food resources in their "territorial waters"; and (e) the nature of ocean mining and the possible dividends to the world's nations. These issues are by no means exhaustive, and as national interests in the utilization of the ocean overlap more frequently, other issues will arise. To date, the world's nations have failed to resolve most of the key issues dealing with the marine environments.

Nationally, attention is increasingly being focused on the need for and wise use of fresh water resources and the concern for the marine environments. There are a number of complex problems facing our Nation with respect to the ocean environments. They include: (a) the lack of understanding by the public of the ways in which we affect the sea and are affected by it; (b) the existence of varying sets of standards with respect to use of the marine and other aquatic environments ranging in philosophy from "humanism" (greatest good for humankind) to "naturalism" (return to pristine conditions); and (c) the protection of our marine

and other aquatic resources from ourselves and from uncontrolled foreign exploitation.

Locally if one were to extend the population backward in time, Hawaii's people have been closely involved with the sea. However, with the imposition of a western socio-economic system and the development of a technological society, the impact on the aquatic ecosystems by just a few has been extremely great. Some of the more severe impacts on the aquatic ecosystems result from the following actions: (a) overfishing of a few species of organisms to the point where these populations may be below the minimum sustainable yield; (b) incorrect use of the coastal areas in terms of resource management; and (c) a lack of the understanding by humans of the fragile balance in the aquatic ecosystems. It should be pointed out that not all of the impacts have been negative ones. What needs to be considered is a more comprehensive awareness of the interactions within and the potentials of the aquatic ecosystems.

Marine education in Hawaii, in some form, has been present since the early 1950's with the opening of the Waikiki Aquarium and the operation of the University of Hawaii's Institute of Marine Biology located at Coconut Island in Kaneohe Bay. The Aquarium offered a variety of educational programs to the general public in the form of docent programs, educational tours, and teacher lecture series. Most of these programs were developed to fit the specific interest of the general public at that time. Beginning in the late sixties, one finds movement in marine education, primarily marine science, at the secondary and elementary levels in the schools. One of the major pioneers in terms of curriculum development during this period was Mr. Shuichi Tanaka, the educational specialist for the Hawaii District of the Department of Education. Mr. Tanaka's Tide Pool Biota guide served as a valuable tool to many elementary and secondary teachers interested in developing tide pool activities for their students. Following this period there were a number of teacher innovators in the seventies who developed and implemented marine science activities to fit the needs of their particular students and programs. The major thrust and focus of these programs were localized student groups with little or no coordination of effort and resources beyond the realm of the individual classroom. As a

consequence there were many in the field who had very little knowledge of the developments in marine education as a coordinated whole.

Materials developed by teachers and the Curriculum Research and Development Group were the beginning of a formalized marine education program in the State of Hawaii. In 1980 the State's Marine Affairs Coordinator's office produced a draft document, Marine and Aquatic Education. This document set the tone, goals, and broad implementation strategies for all state agencies involved with marine and other aquatic enviornments. The Department of Education is developing and coordinating a comprehensive and articulated marine and other aquatic educational program for students, K-12.

B. Rationale

The earth is unlike any other body in our solar system in essentially being a planet that enables water to exist simultaneously in all three states as a liquid, gas and solid. The implications of this consequence for the support of life are immense.

> "Two other characteristics about water are worth a reminder. Its truly remarkable heat capacity enables it to soak up and store great amounts of heat without itself becoming relatively warmer, and it is able to dissolve nearly all natural substances. What is more, water itself is not changed by most of the materials it dissolves. It can act as a carrier, as it does in the human body and can be used as a solvent over and over almost endlessly."[1]

It is not simply the interactions of the biological and physical factors that are important in understanding the aquatic ecosystems, but one also finds that human history, economics, culture, and thoughts are intimately bound to the reality of the earth being a unique water planet.

Hawaii is in a unique position of being the only State in the United States entirely surrounded by the ocean. With this uniqueness comes a series of concerns and problems related to the nature and interaction of humans and the aquatic environments.

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[1] Hal Goodwin and James Schaadt. The Need for Marine and Aquatic Education. Sea Grant 04-6-158-44120, University of Delaware, 1978.

A Marine-literate citizenry is critical to the State's well being and survival. Recent history has shown that the presence of highly sophisticated technology and skilled professionals are not enough to ensure the use and management of our marine and other aquatic resources to guarantee their availability for generations to come. The aquatic environments, both fresh and salt water, have been taken so much for granted that the state's population has become callous in its considerations of them. There is a need for restructuring of attitudes with respect to the use, protection, and appreciation of the aquatic environments and their resources.

Because the quality, supply, and management of fresh water resources and the carefully planned use of the ocean and its resources are major priorities, the development of a marine-literate population is most important. One who is marine-literate would demonstrate the following profile of competencies and understanding:

1. Uses marine conservation and wise-use concepts, practices and values in making decisions as he/she interacts with other people and the aquatic environments;

2. Distinguishes between scientific evidence and personal opinions regarding marine and other aquatic related matters;

3. Recognizes the limitations as well as the usefulness of science and technology in advancing human welfare;

4. Understands the interrelatedness of science technology and other facets of society, including social and economic development when considering issues and problems;

5. Appreciates the aesthetic value of the marine and other aquatic environments;

6. Continues to inquire and increase his/her knowledge about the marine and other aquatic environments;

7. Considers all aspects of safety in relation to the marine and other aquatic environments;

8. Is aware of the range of marine related employment opportunities appropriate for his or her talents, interests, and education.

To meet the needs of an informed citizenry, it will be important to develop and implement a comprehensive instructional delivery system, beginning with the very young children. Since marine and other aquatic education is thematic in its scope, this particular arrangement requires coordination at all levels, and should include the entire range of instructional levels from kindergarten through grade twelve. The development of marine literate students requires effective structuring and sequencing of marine and other aquatic instruction and experiences to promote meaningful and continued learning by the students through adulthood.

The major focus of this program is to insure that the students have equal opportunities to develop to their fullest, their knowledge, skills, attitudes, and values. This program seeks to provide an effective curriculum that is relevant to the students, thereby allowing the students an opportunity to apply their learning to real life situations. Equipped with these necessities and experiences, it is hoped that the students will be able to cope effectively with the demands placed upon them, and that they will develop into concerned citizens who can make wise decisions to reach self-fulfillment and contribute effectively to the welfare of their communities, to society, and to the environment in general.

C. Definitions

MARINE: Although Marine may have several meanings, most people think of the ocean when we refer to that word. In fact, marine comes from the Latin word, "mare," meaning sea. Consequently, "the marine environment is that environment which contains or is directly influenced by salty water, whether it be the open ocean with salt concentrations of 25 parts per thousand or more, or the upper reaches of tidal rivers where salinity approaches zero."[2]

[2] Ibid

AQUATIC: Webster's Third New International Dictionary (1976) defines Aquatic as "of or relating to water." If we take this definition at face value, Aquatic has a global reference to water and it subsumes "marine" waters within its boundaries. However, there is a common underlying feeling among people to relate aquatic to fresh water. Therefore, in this framework, aquatic will refer to fresh water, which is distinct from marine, or salty water.

Together, the words, marine and aquatic, will refer to the totality of water. They include water in all its different forms and locations. The ocean, clouds, streams, puddles, and rain are examples of the broad spectrum of water.

EDUCATION: Education is defined as "the action or process of educating or of being educated."[3] Educate means to "develop (as a person) by fostering to varying degrees the growth or expansion of knowledge, wisdom, desirable qualities of mind or character, physical health, or general competence especially by a course of formal study or instruction."[4]

Given these definitions of marine, aquatic, and education:

> "Marine and other aquatic education is that part of the total educational process which enables people to develop a sensitivity to and a general understanding of the role of the seas and fresh water in human affairs and the impact of society on the marine and aquatic environments."[5]

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[3] Webster's Third New International Dictionary, 1976, page 723.

[4] Ibid

[5] Op cit

II. PROGRAM FRAMEWORK

A. Goal and Objectives

Goals and objectives are the "engineers" in the instructional system. They set the tone, pace, and direction of the curriculum. With goals and objectives, there is better organization and management of the instructional delivery system and learning becomes more meaningful and relevant to the students.

In this section of the framework, we will discuss: 1) The goals and objectives of Marine and Other Aquatic Education, and 2) The relationship of these goals and objectives with those of the Foundation Program.

The goal of Marine and Other Aquatic Education is to develop citizens, who are "literate" in matters dealing with marine and fresh waters, and who through their ethical commitment to wise use of these resources, can create and maintain optimum quality in the marine and other aquatic environments.

To ensure the achievement of this goal, four program objectives were formulated to serve as guidelines in focusing attention on the direction the school curriculum should take when considering marine and other aquatic education. Periodic evaluation and revision of these objectives are necessary to meet the ever-changing needs of a dynamic environment and society. The four program objectives are elaborated below.

Program Objective 1:

Develop awareness of self and society in relation to the marine and other aquatic environments and the need for wise use of the resources within these environments.

- the grandeur, delicacy, and beauty of these environments.
- the capacities and limits of humans to control these environments.
- the effect of these environments on humans and human's effect on these environments.

- the role social institutions play in regulating human interaction with these environments.

- the distinction between human-made and natural environments.

- the recreational and occupational opportunities associated with these environments.

- the principles underlying wise and judicious use of these environments.

Program Objective 2:

Develop understanding of the various components of the marine and other aquatic environments and the relationship of society to these environments.

- the study of human interaction with these environments to bring insight on issues bearing on their use.

- the influence these environments have on individuals and cultures.

- the technologies that deal with the manipulation of these environments and ways of regulating and controlling such manipulation.

- the natural principles that govern the interaction of the physical, biological, chemical, and mechanical components of these environments.

- the social, economic, and political dimensions of marine and aquatic issues that confronts Hawaii and the world.

- the holistic interaction of life, water, land, and atmosphere.

- the agents of change working within th ese environments and their effects, past and present.

- the vehicles for citizen participation in decisions pertaining to these environments.

Program Objective 3:

Develop skills which will enable the student to make wise decisions in matters dealing with the marine and other aquatic environments.

- inquiring and increasing knowledge about these environments.

- probing problems for substance, weighing alternatives, and making wise decisions concerning actions pertaining to these environments.

- functioning in a manner which will not endanger self or others in these enviornments.

- swimming and other recreational activities.

- selecting positive uses of these environments.

Program Objective 4:

Develop attitudes and values which will help the student to live in harmony with the marine and other aquatic environments.

- a positive ethical stance concerning people's use of these environments.

- a concern for and commitment to wise management of these environments.

- a confidence in the ability to solve problems related to these environments.

The goal and objectives of Marine and Other Aquatic Education do not exist in isolation from other educational purposes. In fact, Marine and Other Aquatic Education is another vehicle through which the State Department of Education can accomplish its goal: "to provide educational services and opportunities for the development of all students--mentally, physically, and socially--so that they will be contributing members of society."[6]

The Department of Education has two major plans, The Master Plan for Public Education in Hawaii and The Foundation Program for the Public Schools in Hawaii, that guide the educational activities within our State. In the Foundation Program, there are eight major objectives that elaborate further the desired outcomes the Department is striving for and serve as the basis upon which all curricular and instructional efforts should be directed. They are:

1. Develop basic skills for learning and effective communication with others.

[6] The Foundation Programs for the Public Schools of Hawaii, September 15, 1981, page 1.

2. Develop positive self-concept.

3. Develop decision-making and problem-solving skills.

4. Develop independence in learning.

5. Develop physical and emotional health.

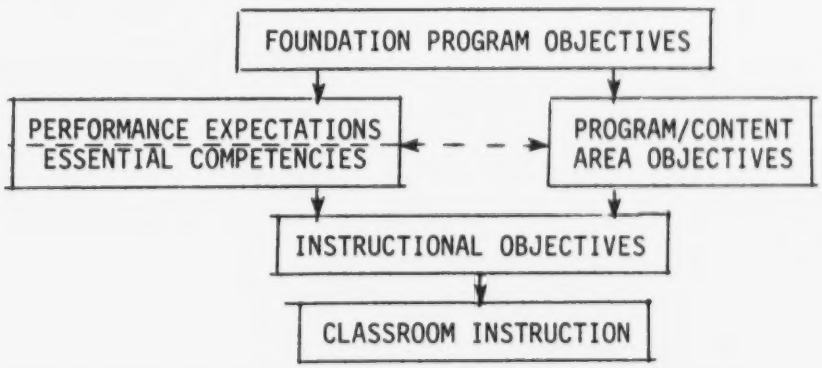
6. Recognize and pursue career development as an integral part of personal growth and development.

7. Develop a continually growing philosophy that reflects responsibility to self as well as to others.

8. Develop creative potential and aesthetic sensitivity.

The Department of Education has also identified performance expectations and essential competencies to insure that the students are attaining the proficiencies necessary to function in the adult world. These learner outcomes can be found in the Student Performance Expectations of the Foundation Program.

The relationship among Foundation Program Objectives, program/content area objectives, performance expectations, essential competencies, instructional objectives, and classroom instruction is shown in the following diagram:



Attainment of the eight Foundation Program Objectives and the objectives of Marine and Other Aquatic Education will assume that the students have gained the necessary knowledge, skills, attitudes, and values needed to cope with the ever-changing demands of the marine and other aquatic environments and of society today.

B. Concept Attainment Model

An understanding of the structural dimensions of a field of knowledge provides the students with a frame of reference for thinking and for evaluating future experiences. Concept teaching provides an opportunity to analyze the students' thinking processes and to help them develop more effective strategies toward problem solving. The concepts for marine and other aquatic education are instructive in such a way that they can form an effective base for problem solving and decision making by the students.

The concepts that follow represent those that are considered to be important in the achievement of marine literacy by students. These listed concepts serve as a baseline for the framework and are not considered to be exhaustive in any sense. It is expected that these baseline concepts will continuously undergo modifications, additions, and even deletions.

Allocation of Resources

The apportioning of available productive agents, human and non-human, among firms and industries engaged in the production of goods and services. It deals with the legitimate role of public information and management of marine and other aquatic resources for limited periods of time to promote the wise use of those resources.

Behavior

Denotes the change, movements, or response of an organism or any system in relation to its environment of situation.

Change

A modification in the modes of thinking or acting in a society. This term avoids any commitments about causes or desirability of the modification.

Competition

Two or more organisms vying for the same environmental resource, food or space. With respect to market conditions, a situation where

many sellers dealing in the same commodity or service attempt to sell as much of their goods as possible to a limited number of buyers; or the striving of many buyers to buy goods and services from a limited supply.

Culture/Cultural Change

All the learned socially-meaningful conducts which are practiced in a given society including customs, norms, languages, economic, and political beliefs. Cultural change refers to any modification, addition or loss of ideas, culture objects, or the practices that are associated with it.

Compromise

A means of resolving a dispute in which the conflicting parties agree, openly or tacitly, to mitigate their differences in order to avoid open controversy.

Decision Making

A process that selects a problem, considers a number of alternatives, and selects a particular alternative for implementation and execution. Decision making denotes the dynamic process among all participants who determine a particular choice (Sill: Gould and Kolb).

Marine and Other Aquatic Ecology

Considers the relations between organisms and their water environments. Specifically the relations that exist in the marine and fresh water environments, and between human groups and their interactions with the water environments.

Control/Power

The authority of jurisdiction granted by law; the ability to coerce another.

Economic Organization

The interaction of marine industries and the economy that affects the range of marine and other aquatic related employment appropriate to the individual's talent, interest, and education.

Environmental Risks

The manner in which interacting systems may affect each other in neutral, positive or negative manners. A particular action may trigger several branched reactions which could have adverse effects for the organisms and their environments.

Global/International

With the increase in technological advancement among the developed nations of the world, there is an increase in the utilization of the ocean's resources. This increased usage and the gap between developed and underdeveloped countries will affect the availability of particular water resources.

Influences

Refers to whatever causes, in any social, biological, and especially political context, individuals or groups to deviate from a predicted path of behavior.

Interdependence

Refers to the conditions of being mutually dependent upon one another. Interdependence may refer to relationships which are economic, social, physical, biological, or political.

Ocean Use

(1) that area of the ocean where life occurs; (2) that which is property; (3) that which is capital; (4) that which invites the economic processes of productivity, and (5) that which is a consumable good.

Scarcity

The supply of economic resources is limited to relative demand.

Ocean Energy

Useful energy obtained from the ocean's waves, geothermal sources, and that energy obtained from the temperature differential between deep layer and surface waters.

Independence

Refers to the condition of being free from dependence upon others for guidance, government, financial, or resource support.

Freedom of the Sea

All people and nations have a certain right to the use of the sea. This idea was formulated in a 1958 Convention dealing with issues revolving around the use of the high seas. The initial formalization of this idea is credited to a Dutch Jurist in the seventeenth century, Hugo Grotius.

Primary Production

Total amount of plant tissue formed by photosynthesis over a specified time.

Food Chain/Food Needs

Refers to energy and matter transfer occurring in the ocean and fresh water ecosystems.

Trophic Relationship

Biological interaction having to do with the transfer of energy from one point on the food chain to another. The concept of trophic level makes possible an analysis of the efficiency of the total system.

Aquatic Organisms Interact in Complex Ecosystems[7]

Water facilitated the chemical evolution of organic compounds and coacervates. Aquatic environments have supported the evolution of a diversity of species.

Aquatic organisms are adapted to their environments in different ways. The aquatic organisms are adapted developmentally, structurally, functionally, and behaviorally to their environments.

Aquatic Ecosystems

Aquatic ecosystems depend on a constant flow of energy and the recycling of materials. Aquatic plants convert solar energy into food energy.

Dynamic Equilibrium

The stability of the aquatic ecosystems tends to be directly proportional to the diversity of their populations and the complexity of relationships among them.

[7]Maura Geens Tyrell and Robert Stequer. "A Conceptual Scheme for Studies of Aquatic Environments" Marine and Aquatic Education (1978)

C. Scope and Sequence

1. Core themes

The core themes for marine and other aquatic education have been derived by integrating the marine and other aquatic related concepts and the views from as many disciplines and interest areas within the community as possible. Since these statements have been obtained from existing community perspectives, their educational use is not necessarily limited to specific subject areas. The following core themes can be applied to a number of program areas as individual unit themes or as combined study cores while maintaining the integrity of the program areas.

An Abundance of Water Makes the Earth Unique in Our Solar System

Water is an essential component for life. With this abundance of water, the earth is set aside from all other planets in the solar system in conditions that are favorable for the continuance of life forms that we know are able to survive.

Alternatives for Using Marine and Other Aquatic Environments and Resources

It is essential that everyone knows that the ocean system is finite, and assuming that we will become more dependent upon the marine resources in the future, it will be important for us to develop technologies and values that will enable us to make wise and considerate use of the ocean and freshwater resources. The ocean offers a wide variety of resources for utilization.

Fundamentals of Marine and Other Aquatic Environments

Without some basic understanding of such a primary aspect of life as the importance of the oceans and freshwaters to health, economic conditions, and the quality of life, people will be ill-equipped to participate in or to influence vital decisions affecting their own welfare relating to the marine and other aquatic environment.

Marine and Other Aquatic Resources vs. Population vs. Food

Because of human's interaction with the sea, the human population has brought forth food, petroleum, minerals, and raw materials of many types, and like the planet earth, the sea has its limits. With the increasing need of developing the resources found in the marine and other aquatic environments, effective management is a clear mandate. With respect to the sea, have we moved from the hunting to the farming state in terms of food resources? As a nation, although the waters off our shores are very productive, we import more than half of the sea products that we consume.

Environmental/Ecological Considerations

We cannot continually dump hazardous wastes without it having some profound effect on the marine environment. Our use of the marine and freshwater resources impacts our environment. What is the relationship of marine and freshwater resource use to environmental impact statements? Must more involvement by people in the water environments mean less of these natural environments?

Marine and Other Aquatic Transportation

The Pacific Ocean provides a water pathway between our State and the rest of the world. Major industrial and agricultural products are moved by water from the mainland to our State, yet as a nation less than ten per cent of our cargoes travel across the ocean in American vessels. Water-borne shipments have the lowest fuel consumption/ton mile, and as the energy crisis becomes more severe, this fact has tremendous implications for the future of shipping and our economic well-being.

Human Dimensions in Marine and Other Aquatic Environments

It is important that each individual understands the relationship between marine and freshwater resource use and the quality of life. There are ethical, legal, aesthetical, social, political, economical, biological and physical benefits and problems associated

in the use of the marine and freshwater resources. There are a number of serious concerns that will have to be mediated. Who controls the ocean's resources? How are we to allocate these resources? Do land-locked nations have any stake in those resources? What value systems determine how the resources in the marine and freshwater enviornments are to be used? How is the individual to interact with his/her water environments?

Appropriate Marine and Other Aquatic Technology

There have been major gains in our use of technology related to the marine and other aquatic enviornment. Projects such as mini-OTEC (Ocean Thermal Energy Conversion) and manganese module mining all point the way to more effective utilization of our State's marine and other aquatic resources. What is the role of appropriate marine and other aquatic technology? What are the values that determine appropriateness?

Marine and Other Aquatic Environments: Cost, Responsibility, Privilege

The prospects of moving to new types of resources have raised once again an old question--the proper role of government. Some argue that government intervention is necessary and proper and others argue that the role of government in marine resource development should be drastically curtailed. This question is particularly acute when we deal with issues like our 200 mile economic zone.

Conservation

Almost everyone agrees that the quickest and cheapest thing to do is conserve. However, conservation implies management principles and wise use practices. How can the marine and other aquatic resource be conserved? Is conservation an inconvenient sacrifice, an economic boon, or a mirage?

Future Perspectives

The potential for use of our marine and freshwater resources is immense but not limitless. There is a vast array of feasible

technologies which can be used as we move toward broader developments and applications of the earth's resources to meet society's needs. There is also a class of technologies, not yet technically feasible, which promise to yield significant gains in the use of the marine and other aquatic resources. A well-informed future-focused society would provide openness to, and support for a commitment to the effective utilization of our marine and other aquatic resources. This well-informed, future-focused society must realize that real progress, brought about by science technology, can shape that culture of which we are a part.

2. Key issues

The issues that are listed address present concerns and are not to be construed as unchanging concerns. These issues will change as the nature of the environment changes, as new technologies that impact on the marine and other aquatic environments develops, and as socio-political attitudes and values change.

- Is there a need for ocean derived energy? What is the cost benefit?
- Should there be economic zones of control?
  - Resource development control?
  - Resource management (scarcity)?
- What is the role of National and State governments in the allocation of resources?
  - Ownership of ocean's resources around the Hawaii Archipelago?
  - Husbandry rights for cultured species in the territorial sea?
  - Aboriginal rights with respect to resource management?
  - Identification and implementation of potential mechanisms to balance conflicting private, governmental, and public interests.
- Who is to decide the existence value of marine species that may not have a direct economical value to the human population?
- Do we need an expanded fishing industry?
- What will be the ecological consequences of increased fishing effort?
- What is the relative priority of fisheries development compared to other state needs?

- Should private or public interest control development of coastal areas?
- Is there a problem for accessibility by the public to coastal areas?
- Do we need to enforce a rigid standard as it relates to the water quality of the coastal zone?
- Does Hawaii's population have a need for strict water safety enforcement?
- Is aquaculture a viable industry for Hawaii to consider?
- Should we commit ourselves to an extensive maritime industry in Hawaii?
- Is Hawaii self sufficient economically--would the maritime industry have any impact on the economy of the State?
- Is ocean mining something we need to actively seek--will it have any detrimental effect on the ocean habitats?

3. Emphases by grades

The divisions of the target populations of the schools are arbitrary; however these divisions attempt to coincide with that which is presently known about students' learning. At the elementary level, one is proceeding from a child's immediate environment and extending his/her experiences and relationships to remote and more removed situations. The focus is on providing students with direct experiences in the marine and other aquatic environments that will allow them to increase their knowledge and skills. As students grow in ability to reason, to generalize, and to see cause and effect relationships, they will be able to more effectively deal with their aquatic environments.

With respect to the secondary level, the students are beginning to assimilate and integrate facts into concepts and conceptual frameworks based on their individual stages of development. At this level, knowledge in content areas and process skills should be developed to foster decision making and problem solving.

The following represent areas of emphasis for the various levels in marine and other aquatic education:

Grades K-3

1. Observations of the various types of fresh and salt water organisms and maintenance of aquaria.

2. Comparative studies of land and water organisms.

3. Consideration of the physical elements of the fresh water, tide pool, marsh, and beach environments through the development of observation skills.

4. Development of positive conservation attitudes about the marine and other aquatic environments.

5. Orientation to basic water safety.

Grades Four-Six

1. Comparative study of cultural uses of the sea.

2. Study of water utilization to include: (1) the material resources of the State; (2) resource management; and (3) local environmental concerns with respect to fresh and salt water use.

3. Development of process skills in problem solving and decision making.

4. Consideration of ecological elements in the marine and other aquatic environments and society's impact on these elements.

5. Development of recreational and safety skills.

Grades Seven-Eight

1. Case studies on local issues to include but not limited to: (a) problems revolving around management of coastal zone areas; (b) the viability of aquaculture in Hawaii; (c) the priority of fisheries in the State's economy; (d) the impact of ocean mining or the habitats in the marine and other aquatic environments; (e) allocation of resources.

2. Focus on experential interaction with the marine and other aquatic ecosystems to include: (a) field investigations of the physical and biological resources; (b) impact of the State's population on the coastline and near shore areas; (c) orientaiton to the marine and other aquatic-related facilities of the State.

3. Study of the interactions of the State with other Pacific Basin Nations in terms of economic zones of control, resource management, and oceanic transportation.

Grades Nine-Twelve

1. National concerns and interactions with the sea from economical, political, social, scientific, and technological perspectives.

2. Further development/knowledge, skills, attitudes, and values about the water environments through present courses that are offered at the secondary level: (a) sciences; (b) social studies; (c) health; (d) language arts; (e) physical education; (f) agriculture; (g) industrial technology; (h) home economics; and (i) arts.

3. Orientation to marine related careers.

4. Development of skills in the marine and other aquatic recreational areas.

The areas of emphasis are not to be considered as new additions to the existing curricula, but as means of integrating aquatic concerns that need to be addressed.

III. MANAGEMENT FRAMEWORK

A. Administrative Objectives

The following administrative objectives will guide the development and maintenance of an effective Marine and Other Aquatic Education Program:

1. Develop appropriate curriculum materials based on the present and emerging needs of the students, communities, and environment. These materials should include: a) rationale for study, b) goals and objectives of both Marine and Other Aquatic Education and the Foundation Program, and c) suggested teaching strategies and activities.

2. Initiate, support, monitor, and evaluate new courses, units, and modules needed to meet the needs of the students, communities, and environment. Marine and Other Aquatic Education program should fit into existing curricula to be most successful in the schools. After thorough examination and possible integration of this program into the subject areas, necessary action should be taken to fill any gaps.

3. Provide staff development opportunities to upgrade knowledge and skills, and to improve attitudes and values.

4. Acquire and maintain community resources to enrich instructional opportunities of the students. This should include resource people, places, materials, supplies, and equipment.

5. Develop and maintain an effective communication system to improve articulation, dissemination, implementation, and evaluation of this program. Effective communication needs to occur within the Department as well as between the Department and the public (including all organizations and agencies directly interested in marine and other aquatic affairs).

6, Provide opportunities for the students to develop and improve their water safety skills.

7. Seek and secure financial and personnel support from private organizations and governmental agencies.

B. Concerns

Marine and Other Aquatic Education has its share of concerns, as every other program area in the educational system. A discussion of some of the concerns, relating to factors affecting effective planning of Marine and Other Aquatic Education follows. As the needs of the students, teachers, and environment change, so will the concerns and priorities of this program.

1. Program integration

Marine and Other Aquatic Education is a thematic program. It spans both horizontally over all subject areas and vertically over all grade levels and types of students. As this program develops, the most practical methods of implementation is the integration of this program into existing curricula at the schools. Department personnel need to design and mutually agree on the most effective method of integrating, disseminating, and implementing this program with other curriculum areas.

2. Attitude of teachers and administrators

The curriculum being taught in the schools today emphasizes the land aspects of the environment. Most school personnel view marine and other aquatic education as an additional offering and see no connection with the present needs of the students. Also the current emphasis is on the basic skills which most people interpret as being language arts and mathematics. These two factors are contributing elements to the low priority given to marine and other aquatic education in the schools.

3. Lack of trained personnel in this program

Presently, there are a few teachers who are committed and knowledgeable about marine and other aquatic education. More teachers are becoming interested in marine education but lack the training and knowledge necessary to do a good job without abusing the environment. With this increase in interest among "amateur" marine educators, an increase in field tripping to aquatic sites is very likely, especially with environmental education funds being available. These teachers need to be taught the proper respect for the ocean and the need for "balanced" use of the resources.

4. Expense of marine experiential activities

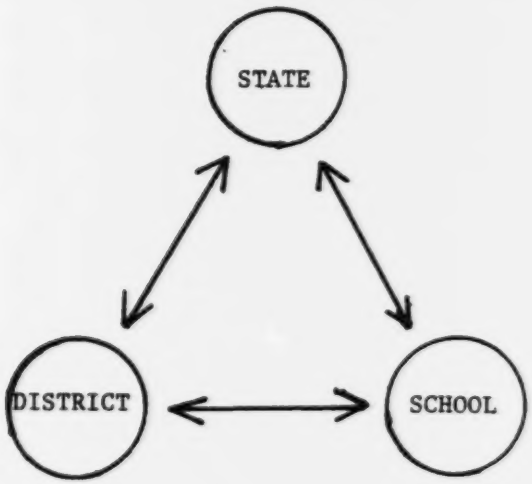
The study of marine and freshwater environments is costly. To give the students hands-on experiences, they need to be bused to different locations and sometimes even on a boat for more in-depth study. Furthermore, providing substitute teachers for teachers who may be taking their classes on field excursions is an additional expense. Department personnel need to analyze alternatives and use the most cost-effective one.

5. Beach and water safety

Many of the island students and teachers have not received adequate water safety training. They have a false sense of security in their swimming ability, and under stressful conditions, they panic. This problem is compounded by the limited availability of swimming pools and certified instructors. Drownproofing classes for the 4th grade students are gaining popularity among the schools; however, scheduling of classes, busing, availability of pools and capable instructors are becoming prominent obstacles to many dis-districts.

C. Communication

The Department of Education in Hawaii is a unique single statewide educational system that functions at three organizational levels: State, District, and School. Each level exists to insure quality education for the students. While the schools provide direct services to their respective students, both the state and district levels exist to support and guide the educational experiences and opportunities of all students.

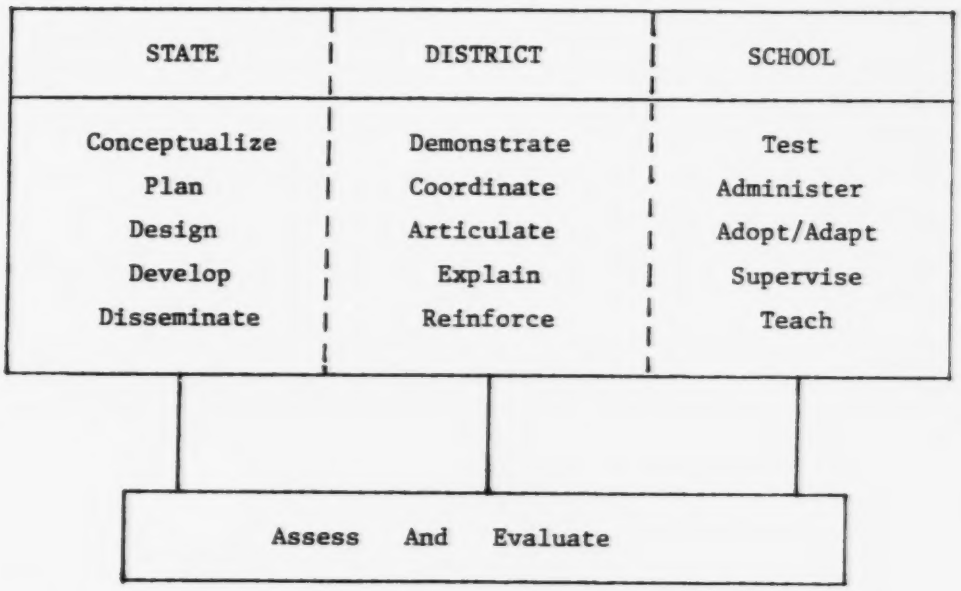


The concern for curricular and instructional improvement is a shared responsibility among all three organizational levels, with each level having a specific function:

State: Overall structuring of the curricula for public schools including conceptualizing, planning, designing, developing, disseminating, upgrading, assessing, evaluating, etc.

District: Implement the overall program for the State including coordinating, articulating, explaining, reinforcing, demonstrating, assessing, evaluating, etc.

School: Utilize the best possible materials, strategies, experiences, and resources to meet the needs of the students, including adopting, adapting, administering, supervising, testing, facilitating, evaluating the effectiveness of the curricula and support services, etc.



Effective communication is essential to guarantee the success of education. It is the means through which behavior can be modified, change can be effected, and goals can be achieved. Every person in the Department of Education shares the responsibility for good communication. At any given time, each person is either an originator or receiver of information. To be most effective, a person needs to know: 1) what and when to communicate, 2) whom to transfer the information to, and 3) the different methods of information transfer, including the formal and informal means of information transfer. Ultimately, people communicate to influence the action of others toward the betterment of the organization.

If marine education is to be successful in the schools, then a good communication network system needs to be developed and maintained. As an initial part of this sytem, educators need to mutually agree on the direction marine eduction should take and understand the purpose of this program. The more we communicate, more ideas will be stimulated, creativity will be fostered, and major duplication of students' experiences will be avoided.

The following recommendations are offered to describe some means of assisting the teachers in the actual delivery of marine and other aquatic education and to provide direct communication linkage with the field:

- Provide a marine education hotline to assist teachers and administrators in the development and implementation of activities, field trips, etc.
- Develop and maintain a series of resource centers to serve as a library and repository for marine and other aquatic information, materials, supplies, and equipment.
- Development and maintain community resource people who can provide services and instruction available for classroom use.
- Develop in-service training opportunities.
- Develop educational television programs in Marine and Other Aquatic Education.
- Develop and maintain an information feedback system that would allow teachers to evaluate support services and make suggestions.
- Obtain a mobile marine van that can serve schools that cannot visit marine related sites.
- Develop and maintain an articulation committee consisting of state, district, and school personnel to discuss and offer alternatives for marine and other aquatic education concerns.
- Develop and maintain a marine and other aquatic education council consisting of representatives from businesses, other private organizations, governmental agencies, and community people who are interested in the improvement of marine and other aquatic education.
- Provide resource teachers at the district, complex, or school level to assist in the implementation of this program.

D. Staff Development

Staff development is the means by which learner and curriculum needs are related to teaching competencies and program development. It involves in-service and other related activities aimed at the improvement of instruction and teaching competency of the professional educational staff. Staff development is a process of change that can support teacher growth, and it

is most effective when viewed as part of program building activities within an educational organization. When considered in the context of program building, staff development shifts from a deficit model where teachers are seen primarily as needing in-service training because they lack professional skills to a model that is an integral part of a program improvement process affecting the entire organization.

A valid staff development program includes: (1) collaborative planning with input from state and district personnel, teachers, and school administrators; (2) a concern for the needs of teachers, students, and schools; and (3) a means by which the overall objectives of the program can be accomplished. This type of planning is necessary for both the short-term and long-term success of a planned change effort.

The staff development plan is intended to provide a comprehensive and systematic effort towards developing and utilizing the capabilities of the educational personnel for delivery of an instructional program in marine and other aquatic education.

Overall coordination of the staff development program will be provided through the collaborative efforts of the state personnel and the implementation process will be through the collaborative efforts of district and school personnel with assistance from the state as needed.

Based on research studies by the Rand Corporation,[8] implementation strategies that incorporated staff-training activities and staff support activities had the most lasting effect on teacher change and program continuation. Of these two elements, staff support activities had the most positive impact on long term outcomes and successes.

[8]Paul Berman and Milbrey McLaughlin, Federal Programs Supporting Educational Change, Vol. IV: The Findings in Review, The Rand Corp. (R-158914-HEW), 1975.

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